

ECOLOGICAL FAUNA AND FLORA HABITAT SURVEY
PORTIONS 174 & 175 ELOFF SMALL HOLDINGS



Mat-forming *Helichrysum caespitium*, at the site.
Photo: R.F. Terblanche September 2011

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1 INTRODUCTION

An ecological habitat survey of flora and fauna was required for Portions 174 & 175 of Eloff Small Holdings, Delmas in which a development is proposed (elsewhere referred to as the site) to determine which threatened fauna or flora may reside on the site. The survey focused on the possibility that fauna or flora of conservation concern, which include threatened species, known to occur in Mpumalanga Province are likely to occur within the proposed development site (and the surrounding area) or not.

1.1 OBJECTIVES OF THE HABITAT STUDY

The objectives of the habitat study are to provide:

- A detailed fauna and flora habitat survey;
- A detailed habitat survey of possible threatened or localised plant species, vertebrates and invertebrates;
- Recording of possible host plants (=foodplants) of fauna such as butterflies.
- Evaluate the conservation importance and significance of the site with special emphasis on the current status of threatened species;
- Literature investigation of possible species that may occur on site;
- Identification of potential ecological impacts on fauna and flora that could occur as a result of the development; and
- Make recommendations to reduce or minimise impacts, should the development be approved.

1.2 SCOPE OF STUDY

- A survey consisting of two visits to investigate key elements of habitats on the site, relevant to the conservation of fauna and flora.
- Recording of any sightings and/or evidence of existing fauna and flora.
- The selective and careful collecting of voucher specimens of invertebrates where deemed necessary.
- An evaluation of the conservation importance and significance of the site with special emphasis on the current status of threatened species.
- Recording of possible host plants or foodplants of fauna such as butterflies.
- Literature investigation of possible species that might occur on site.
- Integration of the literature investigation and field observations to identify potential ecological impacts that could occur as a result of the development.
- Integration of literature investigation and field observations to make recommendations to reduce or minimise impacts, should the development be approved.

2 STUDY AREA

The study area is at Eloff Small Holdings near Delmas in the Mpumalanga Province. The study site is situated at the Grassland Biome (Mucina & Rutherford 2006). Vegetation type at the site is Eastern Highveld Grassland (Mucina & Rutherford 2006). Climate at the Eastern Highveld Grassland is characterised by summer-rainfall and cold, dry winters. Frost is frequent in the winter, especially at higher elevations (Mucina & Rutherford, 2006). Mean annual precipitation varies from 650 – 900mm a year, with an overall average of 726mm per annum. The site is on a flat area with very gentle slopes and with no rocks that surface.

3 METHODS

A desktop study comprised not only an initial phase, but also it was used throughout the study to accommodate and integrate all the data that become available during the field observations.

Surveys by R.F. Terblanche took place on 19 September 2011 and 22 September 2011 to note key elements of habitats on the site, relevant to the conservation of fauna and flora. The main purpose of the site visit was ultimately to serve as a habitat survey that concentrated on the possible presence or not of threatened species and other species of high conservation priority.

The following sections highlight the materials and methods applicable to different aspects that were observed.

3.1 HABITAT CHARACTERISTICS AND VEGETATION

The habitat was investigated by noting habitat structure (rockiness, slope, plant structure/physiognomy) as well as floristic composition. Voucher specimens of plant species were only taken where the taxonomy was in doubt and where the plant specimens were of significant relevance for invertebrate conservation. Field guides such as those by Germishuizen (2003), Manning (2003), Manning (2009), Van Oudtshoorn (1999), Van Wyk (2000), Van Wyk & Malan (1998) and Van Wyk & Van Wyk (1997) were used to confirm the taxonomy of the species. Works on specific plant groups (often genera) such as those by Goldblatt (1986), Goldblatt & Manning (1998), Jacobsen (1983), McMurtry, Grobler, Grobler & Burns (2008), Smit (2008), Van Jaarsveld (2006) and Van Wyk & Smith (2003) were also consulted to confirm the identification of species.

In this case no plant specimens were needed to be collected as voucher specimens or to be send to a herbarium for identification. For the most recent treatise of scientific plant names and broad distributions, Germishuizen, Meyer & Steenkamp (2006) were followed to compile the lists of species.

3.2 MAMMALS

Mammals were noted as sight records by day. For the identification of species and observation of diagnostic characteristics Smithers (1986), Skinner & Chimimba (2005), Cillié, Oberprieler and Joubert (2004) and Apps (2000) are consulted. Sites have been walked, covering as many habitats as possible. Signs of the presence of mammal species, such as calls of animals, animal tracks (spoor), burrows, runways, nests and faeces were recorded. Walker (1996), Stuart & Stuart (2000) and Liebenberg (1990) were consulted for additional information and for the identification of spoor and signs. Trapping was not done since it proved not necessary in the case of this study. Habitat characteristics were also surveyed to note potential occurrences of mammals. Many mammals can be identified from field sightings but, with a few exceptions bats, rodents and shrews can only be reliably identified in the hand, and even then some species needs examination of skulls, or even chromosomes (Apps, 2000).

3.3 BIRDS

Birds were noted as sight records, mainly with the aid of binoculars (10x30). Nearby bird calls of which the observer was sure of the identity were also recorded. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Ryan (2001) is followed. For information on identification, biogeography and ecology Barnes (2000), Hockey, Dean & Ryan, P.G. (2005), Cillié, Oberprieler & Joubert (2004), Tarboton & Erasmus (1998) and Chittenden (2007) were consulted. Ringing of birds fell beyond the scope of this survey and was not deemed necessary. Sites have been walked, covering as many habitats as possible. Signs of the presence of bird species such as spoor and nests have additionally been recorded. Habitat characteristics were surveyed to note potential occurrences of birds.

3.4 REPTILES

Reptiles were noted as sight records in the field. Binoculars (10x30) can also be used for identifying reptiles of which some are wary. For practical skills of noting diagnostic characteristics,

the identification of species and observation techniques, Branch (1998), Marais (2004), Alexander & Marais (2007) and Cillié, Oberprieler and Joubert (2004) were followed. Sites were walked, covering as many habitats as possible. Smaller reptiles are sometimes collected for identification, but this practice was not necessary in the case of this study. Habitat characteristics were surveyed to note potential occurrences of reptiles.

3.5 AMPHIBIANS

Frogs and toads are noted as sight records in the field or by their calls. For practical skills of noting diagnostic characteristics, the identification of species and observation techniques Carruthers (2001), Du Preez (1996), Conradie, Du Preez, Smith & Weldon (2006) and the recent complete guide by Du Preez & Carruthers (2009) are consulted. CD's with frog calls by Carruthers (2001) and Du Preez & Carruthers (2009) are used to identify species by their calls when applicable. Sites are walked, covering as many habitats as possible. Smaller frogs are often collected by pitfall traps put out for epigeal invertebrates (on the soil), but this practice falls beyond the scope of this survey. Habitat characteristics are also surveyed to note potential occurrences of amphibians.

3.6 BUTTERFLIES

Butterflies were noted as sight records or voucher specimens. Voucher specimens are mostly taken of those species of which the taxa warrant collecting due to taxonomic difficulties or in the cases where species can look similar in the veldt. Many butterflies use only one species or a limited number of plant species as host plants for their larvae. Myrmecophilous (ant-loving) butterflies such as the *Aloeides*, *Chrysoritis*, *Erikssonia*, *Lepidochrysops* and *Orachrysops* species (Lepidoptera: Lycaenidae), which live in association with a specific ant species, require a unique ecosystem for their survival (Deutschländer & Bredenkamp, 1999; Terblanche, Morghental & Cilliers, 2003; Edge, Cilliers & Terblanche, 2008; Gardiner & Terblanche, 2010). Known food plants of butterflies were therefore also recorded. After the visits to the site and the identification of the butterflies found there, a list was also compiled of butterflies that will most probably be found in the area in all the other seasons because of suitable habitat. The emphasis is on a habitat survey.

3.7 FRUIT CHAFER BEETLES

Different habitat types in the areas were explored for any sensitive or special fruit chafer species. Selection of methods to find fruit chafers depends on the different types of habitat present and the species that may be present. Fruit bait traps would probably not be successful for capturing *Ichnestoma* species in a grassland patch (Holm & Marais 1992). Possible chafer beetles of high conservation priority were noted as sight records accompanied by the collecting of voucher specimens with grass nets or containers where deemed necessary.

3.8 MYGALOMORPH SPIDERS AND ROCK SCORPIONS

Relatively homogenous habitat / vegetation areas were identified and explored to identify any sensitive or special species. Selected stones that were lifted to search for Arachnids were put back very carefully resulting in the least disturbance possible. The area was searched for possible signs of trap door spiders or other mygalomorph spiders (for example traces of wafer-lids, cork-lids or silk-lined burrows). Investigations by brushing the soil surface with a small broom/paint brush, scraping or digging into the soil with a spade, were made. All the above actions were accompanied by the least disturbance possible.

3.9 LIMITATIONS

For each site visited, it should be emphasized that surveys can by no means result in an exhaustive list of the plants and animals present on the site, because of the time constraint. The on site invertebrate survey was conducted during September 2011 which is an optimal time of the year to find many of the habitat sensitive plant and animal species of high conservation priority. Weather conditions during the survey were favourable for recording fauna and flora. The focus of the survey remains a habitat survey that concentrates on the possibility that species of particular conservation priority occur on the site or not. It is unlikely that more surveys would alter the outcome of this study.

4 RESULTS

4.1 HABITAT AND VEGETATION CHARACTERISTICS

Table 4.1 Outline of main landscape and habitat characteristics of the site.

HABITAT FEATURE	DESCRIPTION
Topography	The site proposed for the developments is on very gentle slopes (flat).
Rockiness	No rocky ridges are present at the site. No rocks surface.
Presence of wetlands	Shallow depressions are present north and east of the site. There is not a conspicuous concentration of wetland plant species or animal species particular to wetlands on the site.
Broad overview of vegetation	Grassland with low species richness is present at the site. Most conspicuous grass species are <i>Hyparrhenia hirta</i> , <i>Eragrostis curvula</i> , <i>Cynodon dactylon</i> and <i>Sporobolus africana</i> . Most of the herbaceous plant species at the site are either exotic weeds or indigenous pioneer species. Such herbaceous weeds include <i>Senecio inaequidens</i> (canary weed), <i>Sonchus oleraceus</i> (sowthistle), <i>Lepidium africanum</i> (pepperweed), <i>Conyza albida</i> (tall fleabane) and <i>Plantago lanceolata</i> (buckhorn plantain). Exotic trees are found in, but especially around the site and include mainly <i>Eucalyptus camaldulensis</i> (red river gum trees/ "bloekoms"). Slight depressions at the eastern part of the site and adjacent to the site, are often covered by patches of exotic <i>Pennisetum clandestinum</i> (kikuyu grass).
Signs of disturbances	The area of which the site forms part is in general disturbed and modified by residential developments and agriculture. A variety of herbaceous weeds are present where the soil has been disturbed. The site borders roads and cultivated fields or modified grasslands opposite the roads.
Connectivity of natural vegetation in the site and between the site and surrounding areas	There is little scope for this site to be a conservation corridor of any particular significance. The remaining grassland patch is small, isolated and does not contain any diversity of plants and animals of particular known conservation priority.



Photo 1 View of the site towards the west. *Hyparrhenia hirta* (thatch grass) is one of the most conspicuous grasses in the foreground.
Photo: September 2011, R.F. Terblanche.



Photo 2 View of the site towards the south. Cultivated fields border the site opposite a road.
Photo: September 2011, R.F. Terblanche.



Photo 3 One of the most conspicuous herbaceous weeds at the site is *Senecio inaequidens* (canary weed).
Photo: September 2011, R.F. Terblanche.



Photo 4 Mat-forming *Helichrysum caespitium* at the site. This plant species favours bare patches between tufts of grass.
Photo: September 2011, R.F. Terblanche.

Table 4.3 Extinct plant species of the Mpumalanga Province. These plant species have been kept on the checklist for the impact assessments because in a few cases extinct species have been rediscovered in the past. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009, updated in 2011). No = Plant species is not a resident on the site; Yes = Plant species is found to be resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Eugenia pusilla</i>	Extinct	No

Table 4.4 Threatened plant species of the Mpumalanga Province that are listed in the **Critically Endangered** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Adenium swazicum</i>	Critically Endangered	No
<i>Aloe craibii</i>	Critically Endangered	No
<i>Aloe simii</i>	Critically Endangered	No
<i>Dioscorea sp. nov.</i>	Critically Endangered	No
<i>Encephalartos cupidus</i>	Critically Endangered	No
<i>Encephalartos heenanii</i>	Critically Endangered	No
<i>Encephalartos laevifolius</i>	Critically Endangered	No
<i>Encephalartos middelburgensis</i>	Critically Endangered	No
<i>Holothrix culveri</i>	Critically Endangered	No
<i>Oberonia disticha</i>	Critically Endangered	No
<i>Protea roupelliae</i> subsp. <i>hamiltonii</i>	Critically Endangered	No
<i>Siphonochilus aethiopicus</i>	Critically Endangered	No

Table 4.5 Threatened plant species of the Mpumalanga Province that are listed in the **Endangered** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Acacia ebutsiniorum</i>	Endangered	No
<i>Adenia wilmsii</i>	Endangered	No
<i>Alepidea basinuda</i> var. <i>subnuda</i>	Endangered	No
<i>Argyrobium muddii</i>	Endangered	No
<i>Asparagus fractiflexus</i>	Endangered	No
<i>Asparagus sekukuniensis</i>	Endangered	No
<i>Disa clavicornis</i>	Endangered	No
<i>Disa vigilans</i>	Endangered	No
<i>Disa zuluensis</i>	Endangered	No
<i>Encephalartos lebomboensis</i>	Endangered	No
<i>Erica rivularis</i>	Endangered	No
<i>Eriosema naviculare</i>	Endangered	No
<i>Frithia humilis</i>	Endangered	No
<i>Gerbera aurantiaca</i>	Endangered	No
<i>Gladiolus cataractarum</i>	Endangered	No
<i>Haworthia koelmaniorum</i> var. <i>mcmurtryi</i>	Endangered	No
<i>Helichrysum leslei</i>	Endangered	No
<i>Helichrysum summo-montanum</i>	Endangered	No
<i>Ledebouria galpinii</i>	Endangered	No
<i>Leucospermum saxosum</i>	Endangered	No
<i>Morella microbracteata</i>	Endangered	No
<i>Ocotea bullata</i>	Endangered	No
<i>Ophioglossum gracillimum</i>	Endangered	No
<i>Pavetta zeyheri</i> subsp. <i>microlancea</i>	Endangered	No
<i>Platycoryne mediocris</i>	Endangered	No
<i>Plinthus rehmannii</i>	Endangered	No
<i>Streptocarpus</i> sp. nov.	Endangered	No
<i>Syncolostemon incanus</i>	Endangered	No
<i>Warburgia salutaris</i>	Endangered	No

Table 4.6 Threatened (= red listed) plant species of the Mpumalanga Province that are listed in the **Vulnerable** category. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Alepidea amatymbica</i>	Vulnerable	No
<i>Aloe challisii</i>	Vulnerable	No
<i>Aloe chortolirioides</i> var. <i>chortolirioides</i>	Vulnerable	No
<i>Aloe integra</i>	Vulnerable	No
<i>Aloe kniphofioides</i>	Vulnerable	No
<i>Aloe modesta</i>	Vulnerable	No
<i>Anacampseros subnuda</i> subsp. <i>lubbersii</i>	Vulnerable	No
<i>Asclepias dissona</i>	Vulnerable	No
<i>Asclepias velutina</i>	Vulnerable	No
<i>APDragus fouriei</i>	Vulnerable	No
<i>Aspidoglossum xanthosphaerum</i>	Vulnerable	No
<i>Aspidonepsis shebae</i>	Vulnerable	No
<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Vulnerable	No
<i>Brachycorythis conica</i> subsp. <i>transvaalensis</i>	Vulnerable	No
<i>Brachystelma dyeri</i>	Vulnerable	No
<i>Brachystelma longifolium</i>	Vulnerable	No
<i>Caesalpinia rostrata</i>	Vulnerable	No
<i>Clivia miniata</i>	Vulnerable	No
<i>Corpuscularia angustipetala</i>	Vulnerable	No
<i>Crassula setulosa</i> var. <i>deminuta</i>	Vulnerable	No
<i>Crocasmia mathewsiana</i>	Vulnerable	No
<i>Crotalaria monophylla</i>	Vulnerable	No
<i>Cyphia bolusii</i>	Vulnerable	No
<i>Cyrtanthus eucallus</i>	Vulnerable	No
<i>Delosperma deilanthoides</i>	Vulnerable	No
<i>Disa alticola</i>	Vulnerable	No
<i>Disa amoena</i>	Vulnerable	No
<i>Dioscorea sylvatica</i>	Vulnerable	No
<i>Dracosciadium italaе</i>	Vulnerable	No

<i>Drimiopsis davidsoniae</i>	Vulnerable	No
<i>Dyschoriste perrottetii</i>	Vulnerable	No
<i>Encephalartos humilis</i>	Vulnerable	No
<i>Encephalartos lanatus</i>	Vulnerable	No
<i>Encephalartos paucidentatus</i>	Vulnerable	No
<i>Erica subverticillaris</i>	Vulnerable	No
<i>Eucomis vandermerwei</i>	Vulnerable	No
<i>Gladiolus malvinus</i>	Vulnerable	No
<i>Gnidia variabilis</i>	Vulnerable	No
<i>Graderia linearifolia</i>	Vulnerable	No
<i>Haworthia koelmaniorum</i> var. <i>koelmaniorum</i>	Vulnerable	No
<i>Haworthia limifolia</i>	Vulnerable	No
<i>Helichrysum aureum</i> var. <i>argenteum</i>	Vulnerable	No
<i>Hesperantha saxicola</i>	Vulnerable	No
<i>Hypodematium crenatum</i> var. <i>crenatum</i>	Vulnerable	No
<i>Hypoxis patula</i>	Vulnerable	No
<i>Indigofera hybrida</i>	Vulnerable	No
<i>Isoetes aequinoctialis</i>	Vulnerable	No
<i>Khadia carolinensis</i>	Vulnerable	No
<i>Knowltonia transvaalensis</i> var. <i>filifolia</i>	Vulnerable	No
<i>Ledebouria mokobulalensis</i>	Vulnerable	No
<i>Lotononis difformis</i>	Vulnerable	No
<i>Melanospermum italaie</i>	Vulnerable	No
<i>Miraglossum davyi</i>	Vulnerable	No
<i>Monopsis kowynensis</i>	Vulnerable	No
<i>Nerine platypetala</i>	Vulnerable	No
<i>Ocotea kenyensis</i>	Vulnerable	No
<i>Oxalis davyana</i>	Vulnerable	No
<i>Ozoroa barbertonensis</i>	Vulnerable	No
<i>Pachycarpus suaveolens</i>	Vulnerable	No
<i>Paersonia hirsuta</i>	Vulnerable	No
<i>Protea curvata</i>	Vulnerable	No
<i>Protea laetans</i>	Vulnerable	No
<i>Protea subvestita</i>	Vulnerable	No
<i>Prunus africana</i>	Vulnerable	No
<i>Rhyncosia rogersii</i>	Vulnerable	No
<i>Sclerochiton triancanthus</i>	Vulnerable	No

<i>Searsia pygmaea</i>	Vulnerable	No
<i>Senecio triodontiphyllus</i>	Vulnerable	No
<i>Streptocarpus cyaneus</i>	Vulnerable	No
<i>Streptocarpus denticulatus</i>	Vulnerable	No
<i>Streptocarpus fasciatus</i>	Vulnerable	No
<i>Streptocarpus fenestra-dei</i>	Vulnerable	No
<i>Streptocarpus hilburtianus</i>	Vulnerable	No
<i>Streptocarpus occultis</i>	Vulnerable	No
<i>Thorncroftia lotterii</i>	Vulnerable	No
<i>Thorncroftia thorncroftii</i>	Vulnerable	No
<i>Tulbaghia coddii</i>	Vulnerable	No
<i>Zantedeschia pentlandii</i>	Vulnerable	No

Table 4.7 Near Threatened plant species of the Mpumalanga Province. The list here follows the most recent updated red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Status: Global status or national status indicated	Resident at the site
<i>Adenia fruticosa</i> subsp. <i>fruticosa</i>	Near Threatened	No
<i>Alepidea attenuata</i>	Near Threatened	No
<i>Aloe albida</i>	Near Threatened	No
<i>Aloe reitzii</i> var. <i>reitzii</i>	Near Threatened	No
<i>Aloe thorncroftii</i>	Near Threatened	No
<i>Argyrobium megarrhizum</i>	Near Threatened	No
<i>Cineraria austrotransvaalensis</i>	Near Threatened	No
<i>Clivia caulescens</i>	Near Threatened	No
<i>Curtisia dentata</i>	Near Threatened	No
<i>Delosperma leendertziae</i>	Near Threatened	No
<i>Disa extinctoria</i>	Near Threatened	No
<i>Disa maculomarronina</i>	Near Threatened	No
<i>Drimia sanguinea</i>	Near Threatened	No
<i>Elaeodendron transvaalense</i>	Near Threatened	No
<i>Erica atherstonei</i>	Near Threatened	No
<i>Eucomis pallidiflora</i> subsp. <i>pole- evansii</i>	Near Threatened	No
<i>Gasteria batesiana</i> var. <i>batesiana</i>	Near Threatened	No

<i>Gladiolus robertsoniae</i>	Near Threatened	No
<i>Habenaria barbertoni</i>	Near Threatened	No
<i>Habenaria bicolor</i>	Near Threatened	No
<i>Habenaria kraenzliniana</i>	Near Threatened	No
<i>Isoetes transvaalensis</i>	Near Threatened	No
<i>Isoetes welwitchii</i>	Near Threatened	No
<i>Jamesbrittenia macrantha</i>	Near Threatened	No
<i>Kniphofia typhoides</i>	Near Threatened	No
<i>Leucospermum gerrardii</i>	Near Threatened	No
<i>Lithops leslei</i> subsp. <i>leslei</i>	Near Threatened	No
<i>Lydenburgia cassinoides</i>	Near threatened	No
<i>Merwillia plumbea</i>	Near Threatened	No
<i>Nerine gracilis</i>	Near Threatened	No
<i>Protea comptonii</i>	Near Threatened	No
<i>Protea parvula</i>	Near Threatened	No
<i>Riocreuxia aberrans</i>	Near Threatened	No
<i>Trachyandra erythrorrhiza</i>	Near Threatened	No
<i>Urginea lydenburgensis</i>	Near Threatened	No

Table 4.8 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Critically Rare** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Blepharis fenestralis</i>	Critically Rare	No
<i>Euclea dewinteri</i>	Critically Rare	No

Table 4.9 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Rare** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Aloe hardyi</i>	Rare	No
<i>Barleria oxyphylla</i>	Rare	No
<i>Berkheya coddii</i>	Rare	No
<i>Bowkeria citrina</i>	Rare	No
<i>Brachystelma remotum</i>	Rare	No
<i>Brachystelma stellatum</i>	Rare	No
<i>Brachystelma villosum</i>	Rare	No
<i>Combretum petrophilum</i>	Rare	No
<i>Dicoma swazilandica</i>	Rare	No
<i>Dracaena transvaalensis</i>	Rare	No
<i>Euphorbia sekukuniensis</i>	Rare	No
<i>Faurea macnaughtonii</i>	Rare	No
<i>Gladiolus pardalinus</i>	Rare	No
<i>Gladiolus pole-evansii</i>	Rare	No
<i>Gladiolus rufomarginatus</i>	Rare	No
<i>Gladiolus saxatilis</i>	Rare	No
<i>Gladiolus serpenticola</i>	Rare	No
<i>Gymnosporia devenishii</i>	Rare	No
<i>Haemanthus pauculifolius</i>	Rare	No
<i>Helichrysum calocephalum</i>	Rare	No
<i>Helichrysum ephelos</i>	Rare	No
<i>Helichrysum homilochrysum</i>	Rare	No
<i>Hesperantha brevicaulis</i>	Rare	No
<i>Indigofera amitina</i>	Rare	No
<i>Khadia alticola</i>	Rare	No
<i>Kniphofia triangularis</i> subsp. <i>obtusiloba</i>	Rare	No
<i>Ledebouria cremnophila</i>	Rare	No
<i>Lobelia trullifolia</i> subsp. <i>delicatula</i>	Rare	No
<i>Lotononis amajubica</i>	Rare	No
<i>Nesaea alata</i>	Rare	No
<i>Pelargonium album</i>	Rare	No
<i>Rhoicissus laetans</i>	Rare	No
<i>Satyrium microrrhynchum</i>	Rare	No

<i>Schizochilus ceciliae</i> subsp. <i>culveri</i>	Rare	No
<i>Schizochilus lilacinus</i>	Rare	No
<i>Searsia dracomontana</i>	Rare	No
<i>Selago longicalyx</i>	Rare	No
<i>Senecio hederiformis</i>	Rare	No
<i>Streptocarpus decipiens</i>	Rare	No
<i>Streptocarpus latens</i>	Rare	No
<i>Streptocarpus pogonites</i>	Rare	No
<i>Syncolostemon stalmanii</i>	Rare	No
<i>Thorncroftia longiflora</i>	Rare	No
<i>Woodia singularis</i>	Rare	No

Table 4.10 Least Concern (= not threatened) plant species of the Mpumalanga Province that are however of particular conservation concern and listed in the **Declining** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Acridocarpus natalitius</i>	Declining	No
<i>Adenia gummifera</i> subsp. <i>gummifera</i>	Declining	No
<i>Aloe cooperi</i> subsp. <i>cooperi</i>	Declining	No
<i>Ansellia africana</i>	Declining	No
<i>Balanites maughamii</i>	Declining	No
<i>Boophone disticha</i>	Declining	No
<i>Callilepis leptophylla</i>	Declining	No
<i>Cassipourea malosana</i>	Declining	No
<i>Crinum bulbispermum</i>	Declining	No
<i>Crinum macowanii</i>	Declining	No
<i>Crinum stuhlmanii</i>	Declining	No
<i>Cryptocarya transvaalensis</i>	Declining	No
<i>Cyathea capensis</i> var. <i>capensis</i>	Declining	No
<i>Drimia altissima</i>	Declining	No
<i>Elaeodendron croceum</i>	Declining	No
<i>Eucomis autumnalis</i>	Declining	No
<i>Eucomis montana</i>	Declining	No
<i>Eulophia speciosa</i>	Declining	No
<i>Gunnera perpensa</i>	Declining	No
<i>Hypoxis hemerocallidea</i>	Declining	No
<i>Ilex mitis</i>	Declining	No

<i>Pelargonium sidoides</i>	Declining	No
<i>Pterocelastrus rostratus</i>	Declining	No
<i>Rapanea melanophloeos</i>	Declining	No
<i>Sandersonia aurantiaca</i>	Declining	No

Table 4.11 Plant species of the Mpumalanga Province of which the conservation status is uncertain owing to a lack of information and which are listed in the **Data Deficient** category. The list here follows the most recent red list of South African plant species (Raimondo *et al.* 2009). No = Plant species is not a resident on the site; Yes = Plant species is unlikely to be found a resident on the site.

Species	Conservation status	Resident at the site
<i>Aspidoglossum demissum</i>	Data Deficient	No
<i>Ceropegia distincta</i> subsp. <i>verruculosa</i>	Data Deficient	No
<i>Ceropegia scabriflora</i>	Data Deficient	No
<i>Cleome schlechteri</i>	Data Deficient	No
<i>Colchicum swazicum</i>	Data deficient	No
<i>Cephalaria amerioides</i>	Data Deficient	No
<i>Delosperma annulare</i>	Data Deficient	No
<i>Delosperma rileyi</i>	Data Deficient	No
<i>Delosperma zeederbergii</i>	Data Deficient	No
<i>Eulophia chlorantha</i>	Data deficient	No
<i>Euryops discoideus</i>	Data Deficient	No
<i>Hesperantha rupestris</i>	Data Deficient	No
<i>Kalanchoe alticola</i>	Data Deficient	No
<i>Ledebouria parvifolia</i>	Data Deficient	No
<i>Pentatrichia alata</i>	Data Deficient	No
<i>Plectranthus esculentus</i>	Data Deficient	No
<i>Senecio eminens</i>	Data Deficient	No
<i>Senecio latissimifolius</i>	Data Deficient	No
<i>Thesium subsimile</i>	Data Deficient	No

4.3 VERTEBRATE SPECIES OF PARTICULAR CONSERVATION PRIORITY

4.3.1 Mammals of particular high conservation priority

Table 4.12 Threatened mammal species of the Mpumalanga Province. Literature sources: Friedman & Daly, (2004), Skinner & Chimimba (2005), Wilson & Reeder (2005). With mammal species which normally needs a large range their residential status does not implicate that they are exclusively dependent on the site or use the site as important shelter or for reproduction. No = Not recorded at site/ Unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Red Listed Status	Recorded at site during survey	Likely to be resident at the site
<i>Chlorotalpa sclateri</i> Sclater's Golden Mole	Vulnerable	No	No
<i>Mystromys albicaudatus</i> White-tailed mouse	Endangered	No	No
<i>Cistugo lesueuri</i> Lesueur's hairy bat	Vulnerable	No	No

Table 4.13 Near Threatened mammal species known to occur in the Mpumalanga Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Red Listed Status	Recorded at site during survey	Likely to be a resident at the site
<i>Ceratotherium simum</i> White Rhinoceros	Near Threatened	No	No
<i>Manis temminckii</i> Ground Pangolin	Lower risk/ Near Threatened	No	No

Table 4.14 Data deficient (or uncertain) mammal species of the Mpumalanga Province. Literature sources: Skinner & Chimimba (2005). No = Not recorded at site/ unlikely to be resident at the site. Yes: Recorded at the site/ Likely to be resident at the site.

Species	Red Listed Status	Recorded at site during survey	Likely be a resident at the site
<i>Myosorex varius</i> Forest shrew	Uncertain	No	No

4.3.2 Birds of particular high conservation priority

Table 4.15 Bird species of particular conservation concern in the Mpumalanga Province. Literature sources Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). No = Bird species is not a resident at the site. Yes = Bird species is a resident at the site.

Species	Common name	Red Listed Status	Recorded at site during survey	Likely to be resident at the site based on habitat assessments or observation
<i>Aegypius occipitalus</i>	White-headed Vulture	Vulnerable	No	No
<i>Aegypius tracheliotos</i>	Lappet-faced Vulture	Vulnerable	No	No
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near-threatened	No	No
<i>Anastomus lamelligerus</i>	African Openbill	Near-threatened	No	No
<i>Anthropoides paradiseus</i>	Blue Crane	Vulnerable	No	No
<i>Anthus chloris</i>	Yellow-breasted Pipit	Vulnerable (Globally)	No	No
<i>Apalis ruddi</i>	Rudd's Apalis	Near-threatened	No	No
<i>Aquila ayresii</i>	Ayres's Hawk-Eagle	Near-threatened	No	No
<i>Aquila rapax</i>	Tawny Eagle	Vulnerable	No	No
<i>Ardeotis kori</i>	Kori Bustard	Vulnerable	No	No
<i>Balearica regulorum</i>	Grey Crowned Crane (Mahem)	Vulnerable	No	No
<i>Botaurus stellaris</i>	Eurasian Bittern	Critically Endangered	No	No
<i>Bucorvis leadbeateri</i>	Southern Ground-hornbill	Vulnerable (in South Africa)	No	No
<i>Bugeranus carunculatus</i>	Wattled Crane	Vulnerable (Globally) Critically Endangered (RSA)	No	No
<i>Buphagus africanus</i>	Yellow-billed Oxpecker	Vulnerable	No	No

<i>Buphagus erythrorhynchus</i>	Red-Billed Oxpecker	Near-threatened	No	No
<i>Centropus grillii</i>	Black Coucal	Near-threatened	No	No
<i>Charadrius pallidus</i>	Chestnut-banded Plover	Near-threatened	No	No
<i>Ciconia nigra</i>	Black Stork	Near-threatened	No	No
<i>Circus macrourus</i>	Pallid Harrier	Near-threatened	No	No
<i>Circus ranivorus</i>	African Marsh- Harrier	Vulnerable	No	No
<i>Crex crex</i>	Corn Crake	Vulnerable	No	No
<i>Ephippiorhynchus senegalensis</i>	Saddle-billed Stork	Endangered (in RSA)	No	No
<i>Eupodotis caeruleascens</i>	Blue Korhaan	Near-threatened	No	No
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable	No	No
<i>Falco biarmicus</i>	Lanner Falcon	Near-threatened	No	No
<i>Falco naumanni</i>	Lesser Kestrel	Vulnerable	No	No
<i>Falco peregrinus</i>	Peregrine Falcon	Near-threatened	No	No
<i>Geronticus calvus</i>	Southern Bald Ibis	Vulnerable	No	No
<i>Glareola nordmanni</i>	Black-winged Pratincole	Near-threatened	No	No
<i>Glareola pranticola</i>	Collared Pranticole	Near-threatened	No	No
<i>Gorsachius leuconotus</i>	White-backed Night-heron	Vulnerable	No	No
<i>Gyps africanus</i>	White-backed Vulture	Vulnerable	No	No
<i>Gyps coprotheres</i>	Cape Vulture	Vulnerable	No	No
<i>Heteromira fra ruddi</i>	Rudd's Lark	Critically Endangered (Globally)	No	No
<i>Hirundo atrocaerulea</i>	Blue Swallow	Critically Endangered	No	No

		(in RSA)		
<i>Hypargos margaritatus</i>	Pink-throated Twinspot	Near-threatened	No	No
<i>Leptoptilos crumeniferus</i>	Marabou Stork	Near-threatened	No	No
<i>Lioptilus nigricapillus</i>	Bush Blackcap	Near-threatened	No	No
<i>Lissotis melanogaster</i>	Black-bellied Bustard	Near-threatened	No	No
<i>Macheiramphus alcinus</i>	Bat Hawk	Near-threatened	No	No
<i>Mirafrā cheniana</i>	Melodious lark	Near-threatened	No	No
<i>Mycteria ibis</i>	Yellow-billed Stork	Near-threatened	No	No
<i>Neophron percnopterus</i>	Egyptian Vulture	Regionally almost extinct	No	No
<i>Neotis denhami</i>	Denham's Bustard	Vulnerable	No	No
<i>Nettapus auritus</i>	African Pygmy-goose	Near-threatened	No	No
<i>Pelecanus onocrotalus</i>	Great White Pelican	Near-threatened	No	No
<i>Pelecanus rufescens</i>	Pink-backed Pelican	Vulnerable	No	No
<i>Phoenicopterus minor</i>	Lesser Flamingo	Near-threatened	No	No
<i>Phoenicopterus ruber</i>	Greater Flamingo	Near-threatened	No	No
<i>Platysteira peltata</i>	Black-throated Wattle-eye	Near-threatened	No	No
<i>Polemaetus bellicosus</i>	Martial Eagle	Vulnerable	No	No
<i>Rostratula benghalensis</i>	Greater Painted-snipe	Near-threatened	No	No
<i>Rhynchops flavirostris</i>	African Skimmer	Endangered	No	No
<i>Sagittarius serpentarius</i>	Secretarybird	Near-threatened	No	No
<i>Sarothrura affinis</i>	Striped Flufftail	Vulnerable	No	No
<i>Sarothrura ayresi</i>	White-winged Flufftail	Critically Endangered	No	No
<i>Schoenicola brevirostris</i>	Broad-tailed Warbler	Near-threatened	No	No

<i>Scotopelia peli</i>	Pel's Fishing-Owl	Vulnerable	No	No
<i>Spermestes fringilloides</i>	Magpie Mannikin	Near-threatened	No	No
<i>Spizocorys fringillaris</i>	Botha's Lark	Endangered (Globally)	No	No
<i>Stephanoaetus coronatus</i>	African Crowned Eagle	Near-threatened	No	No
<i>Sterna caspia</i>	Caspian Tern	Near-threatened	No	No
<i>Therathopius ecaudatus</i>	Bateleur	Vulnerable (in southern Africa)	No	No
<i>Turnix nanus</i>	Black-rumped Buttonquail	Endangered	No	No
<i>Tyto capensis</i>	African Grass-Owl	Vulnerable	No	No
<i>Vanellus albiceps</i>	White-crowned Lapwing	Near-threatened	No	No
<i>Vanellus melanopterus</i>	Black-winged lapwing	Near-threatened	No	No
<i>Zoothera gurneyi</i>	Orange ground-thrush	Near-threatened	No	No

4.3.3 Reptiles of particular high conservation priority

The following tables list possible presence or absence of threatened reptile or Near Threatened reptile species in the study area. The Southern African Reptile Conservation Assessment (SARCA) was launched in May 2005 (Branch, Tolley, Cunningham, Bauer, Alexander, Harrison, Turner & Bates, 2006). Its primary aim is to produce a conservation assessment for reptiles of South Africa, Lesotho and Swaziland within a four year period, ending 2009 (Branch *et al.*, 2006). A full up-dated conservation assessment of reptiles, taking into account the recent IUCN (2001) criteria, can only be used once it becomes available. Alexander & Marais (2007) and Tolley & Burger (2007) give useful indications of present conservation statuses as well as possible red listings of reptile species and subspecies in the near future.

Table 4.16 Threatened reptile species of the Mpumalanga Province that are listed in the **Vulnerable** category. Note the reptile atlas with revised conservation assessment is only likely to be available by the end of 2009. Sources: Alexander & Marais (2007), Branch (1998), Tolley & Burger (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Cordylus giganteus</i> *	Sungazer	Vulnerable	No	No
<i>Python natalensis</i> **	Southern African Python	Vulnerable	No	No

**Cordylus giganteus* is classified by the IUCN as Vulnerable and numbers are declining (Alexander & Marais 2007)

**Although declining in some areas *Python natalensis* is unlikely to retain threatened status when reassessed according to the latest IUCN criteria (Alexander & Marais 2007)

Table 4.17 Near Threatened reptile species of the Mpumalanga Province. Note the reptile atlas with revised conservation assessment is only likely to be available by the end of 2009. Sources: Alexander & Marais (2007), Branch (1998), Tolley & Burger (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	Near Threatened	No	No
<i>Kinixys natalensis</i>	Natal Hinged Tortoise	Near Threatened	No	No
<i>Lamprophis swazicus</i>	Swazi Rock Snake	Near Threatened	No	No

Table 4.18 Reptile species species of the Mpumalanga Province of which the conservation status is uncertain owing to a lack of information and which are listed in the **Data Deficient** category. Sources: Alexander & Marais (2007), Branch (1998), Tolley & Burger (2007). No = Reptile species is not a resident on the site; Yes = Reptile species is found to be resident on the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Xencocalamus transvaalensis</i>	Transvaal Quill-snouted Snake	Data Deficient	No	No

4.3.4 Amphibian species of particular high conservation priority

Table 4.19 Threatened amphibian species of the Mpumalanga Province which are listed in the **Vulnerable** category. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Hemisus guttatus</i>	Spotted Shovel-nosed Frog	Vulnerable	No	No

Table 4.20 Near Threatened amphibian species in Mpumalanga Province. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	Near Threatened	No	No
<i>Strongylopus wageri</i>	Plain Stream Frog	Near Threatened	No	No

Table 4.21 Amphibian species of the Mpumalanga Province of which the conservation status is uncertain owing to a lack of information and which are listed in the **Data Deficient** category. Sources: Minter *et al.* (2004), Du Preez & Carruthers (2009). No = Amphibian species is unlikely to be resident at the site; Yes = Amphibian species is likely to be resident at the site.

Species	Common name	Conservation status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Breviceps sopranus</i>	Whistling Rain Frog	Data Deficient	No	No

4.4 INVERTEBRATE SPECIES OF PARTICULAR HIGH CONSERVATION PRIORITY

4.4.1 Butterfly species of particular high conservation priority

Table 4.22 Threatened butterfly species in Mpumalanga Province which appear in the present revised South African red data book of butterflies (Henning, Terblanche & Ball, 2009). Invertebrates such as threatened butterfly species are often very habitat specific and residential status imply a unique ecosystem that is at stake.

Species	Common name	Conservation Status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Aloeides barbara</i>	Barbara's Copper	Endangered	No	No
<i>Aloeides nubilus</i>	Cloud Copper	Endangered	No	No
<i>Aloeides rossouwi</i>	Rossouw's Copper	Endangered	No	No
<i>Chrysoritis aureus</i>	Golden Opal	Vulnerable	No	No
<i>Dingana fraterna</i>	Fraternal Widow	Endangered	No	No
<i>Lepidochrysops irvingi</i>	Irving's Blue	Vulnerable	No	No
<i>Lepidochrysops jefferyi</i>	Jeffery's Blue	Endangered	No	No
<i>Lepidochrysops rossouwi</i>	Rossouw's Blue	Vulnerable	No	No
<i>Lepidochrysops swanepoeli</i>	Swanepoel's Blue	Vulnerable	No	No
<i>Metisella meninx</i>	Marsh Sylph	Vulnerable	No	No
<i>Platylesches dolomitica</i>	Dolomite Hopper	Vulnerable	No	No

4.4.2 Fruit chafer beetle species of particular high conservation priority

Table 4.23 Fruit chafer beetle species of the Mpumalanga Province of which the conservation status is uncertain (not a formal category) owing to a lack of information. Sources: Holm & Marais (1992). No = Fruit chafer beetle species is unlikely to be resident at the site; Yes = Fruit chafer beetle species is likely to be resident at the site.

Species	Common name	Conservation Status	Recorded at site during survey	Likely to be resident based on habitat assessment
<i>Discopeltis barbertonensis</i>	-	Uncertain/ Restricted range	No	No
<i>Trichocephala brincki</i>	-	Uncertain/ Data Deficient	No	No

5 DISCUSSION

5.1 HABITAT AND VEGETATION CHARACTERISTICS

An outline of the habitat and vegetation characteristics is given in Table 4.1. This habitat outline serves as an important reference to presence or absence of particular biodiversity and habitat specialist species.

5.2 PLANT SPECIES

Extinct, threatened, near threatened and other plant species of high conservation priority in Mpumalanga Province are listed in Tables 4.2 – 4.11. The presence or not of all the species listed in the tables were investigated during the survey. None of the plant species of particular conservation priority occurs on the site.

5.3 VERTEBRATES

5.3.1 Mammals

Table 4.12, Table 4.13 and Table 4.14 list the possible presence or absence of threatened mammal species, near threatened mammal species and mammal species of which the status is uncertain, respectively, at the site. Literature sources that were used are Friedman & Daly (2004), Skinner & Chimimba (2005) and Wilson & Reeder (2005). Since the site falls outside reserves, threatened species such as the black rhinoceros (*Diceros bicornis*) and the African wild dog (*Lycaon pictus*) are obviously not present. No smaller mammals of particular high conservation significance are likely to be found on the site as well.

5.3.2 Birds

Table 4.15 list the possible presence or absence of threatened bird species and near threatened bird species at the site. Literature sources that were mainly consulted are Barnes (2000), Hockey, Dean & Ryan, P.G. (2005) and Chittenden (2007). The site does not appear to form part of any

habitat of particular importance for any threatened bird species or any other bird species of particular conservation importance.

5.3.3 Reptiles

Table 4.16 and Table 4.17 list the possible presence or absence of threatened and near threatened reptile species on the site. The Southern African Reptile Conservation Assessment (SARCA) was launched in May 2005 (Branch, Tolley, Cunningham, Bauer, Alexander, Harrison, Turner & Bates, 2006). Its primary aim is to produce a conservation assessment for reptiles of South Africa, Lesotho and Swaziland which should be produced in the near future (Branch *et al.*, 2006). Therefore a full up-dated conservation assessment of reptiles, taking into account the recent IUCN (2001) criteria, will only be available in the near future. While the conservation statuses of reptile species are under revision Alexander & Marais (2007) as well as Tolley & Burger 2007) give useful indications of possible red listings in the near future. There appears to be no threat to any reptile species of particular high conservation importance if the site is developed.

5.3.4 Amphibians

Threatened and Near Threatened frog species that occur in the Mpumalanga Province are listed in Table 4.20 and Table 4.21. Minter, Burger, Harrison, Braack, Bishop and Kloepfer (2004) as well as Du Preez & Carruthers (2009) are followed for compiling these tables. There is no suitable habitat for threatened or near threatened amphibians at the site and it is unlikely that any amphibian species of particular high conservation importance would be threatened if the site is developed.

5.4 INVERTEBRATES

5.4.1 Butterflies

Studies about the vegetation and habitat of threatened butterfly species in South Africa showed that ecosystems with a unique combination of features are selected by these often localised threatened butterfly species (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Threatened butterfly species in South Africa can then be regarded as bio-indicators of rare ecosystems.

Six species of butterfly in Gauteng Province are listed in the revised red list and South African Red Data Book: butterflies (G.A. Henning, Terblanche & Ball, 2009). The expected presence or not of these threatened butterfly species (Table 4.22) follows.

***Chrysoritis aureus* (Golden Opal/ Heidelberg Copper)**

The proposed global red list status for *Chrysoritis aureus* according to the most recent IUCN criteria and categories is Vulnerable [VU B1ab(ii,iv)+2ab(ii,iv); D2] (G.A. Henning, Terblanche & Ball, 2009). *Chrysoritis aureus* (Golden Opal/ Heidelberg Copper) is a resident where the larval host plant, *Clutia pulchella* is present. However, the distribution of the butterfly is much more restricted than that of the larval host plant (S.F. Henning 1983; Terblanche, Morgenthal & Cilliers 2003). One of the reasons for the localised distribution of *Chrysoritis aureus* is that a specific host ant *Crematogaster liengmei* must also be present at the habitat. Research revealed that *Chrysoritis aureus* (Golden Opal/ Heidelberg Copper) has very specific habitat requirements, which include rocky ridges with a steep slope and a southern aspect (Terblanche, Morgenthal & Cilliers, 2003). No *Chrysoritis aureus* was recorded on the site and it is unlikely that the butterfly will be present.

***Aloeides dentatis dentatis* (Roodepoort Copper)**

The proposed global red list status for *Aloeides dentatis dentatis* according to the most recent IUCN criteria and categories is Vulnerable [VU B2ab(ii,iii); D2] (G.A. Henning, Terblanche & Ball, 2009). *Aloeides dentatis dentatis* colonies are found where one of its host plants *Hermannia depressa* or *Lotononis eriantha* is present. Larval ant association is with *Lepisiota capensis* (S.F. Henning, 1983; S.F. Henning & G.A. Henning, 1989). The habitat requirements of *Aloeides*

dentatis dentatis are complex and not fully understood yet. See Deutschländer and Breckenkamp (1999) for the description of the vegetation and habitat characteristics of one locality of *Aloeides dentatis* subsp. *dentatis* at Ruimsig, Roodepoort, Gauteng Province. There is not an ideal habitat of *Aloeides dentatis* subsp. *dentatis* on the site and it is unlikely that the butterfly is present at the site.

***Lepidochrysops praeterita* (Highveld Blue)**

The proposed global red list status for *Lepidochrysops praeterita* according to the most recent IUCN criteria and categories is Endangered [EN A2c; B1ab(iv)+2ab(iv)] (G.A. Henning, Terblanche & Ball, 2009). *Lepidochrysops praeterita* is a butterfly that occurs where the larval host plant *Ocimum obovatum* (= *Becium obovatum*) is present (Pringle, G.A. Henning & Ball, 1994), but the distribution of the butterfly is much more restricted than the distribution of the host plant. *Lepidochrysops praeterita* is found on selected rocky ridges and rocky hillsides in parts of Gauteng, the extreme northern Free State and the south-eastern Gauteng Province. No ideal habitat appears to be present for the butterfly on the site. It is unlikely that *Lepidochrysops praeterita* would be present on the site.

***Metisella meninx* (marsh sylph)**

The proposed global red status for *Metisella meninx* according to the most recent IUCN criteria and categories is Vulnerable [VU A3ce] (G.A. Henning, Terblanche & Ball, 2009). The larval host plant of *Metisella meninx* is rice grass, *Leersia hexandra* (G.A. Henning & Roos, 2001). Unlike many other threatened butterfly species in South Africa no specific association with ant species is present in the early stages of the life cycle of the *Metisella meninx*. The ideal habitat of *Metisella meninx* is treeless marshy areas where *Leersia hexandra* (rice grass) is abundant. There is no suitable habitat for *Metisella meninx* on the site and it is unlikely that the butterfly would be resident at the site.

***Platylesches dolomitica* (Dolomite Hopper)**

The proposed global red status for *Platylesches dolomitica* according to the most recent IUCN criteria and categories is Vulnerable [VU D2] (G.A. Henning, Terblanche & Ball, 2009). *Platylesches dolomitica* is a rare butterfly of which the habitat, presumably dolomite ridges, is still poorly known. *Platylesches dolomitica* was not found on the site.

***Orachrysops mijburghi* (Mijburgh's Blue)**

The proposed global red status for *Orachrysops mijburghi* according to the most recent IUCN criteria and categories is Vulnerable [VU D2] (G.A. Henning, Terblanche & Ball, 2009). *Orachrysops mijburghi* favours grassland depressions where specific *Indigofera* plant species occur (Terblanche & Edge 2007). The Heilbron population of *Orachrysops mijburghi* in the Free State uses *Indigofera evansiana* as a larval host plant (Edge, 2005) while the Suikerbosrand population in Gauteng uses *Indigofera dimidiata* as a larval host plant (Terblanche & Edge 2007). There is no suitable habitat for *Orachrysops mijburghi* on the site and it is unlikely that *Orachrysops mijburghi* would be present on the site.

Conclusion on threatened butterfly species

There appears to be no threat to any red listed butterfly species if the study site is developed.

5.4.2 Fruit chafer beetles

Table 4.23 lists the fruit chafer beetle species (Coleoptera: Scarabaeidae: Cetoninae) that are of possible high conservation priority in the Mpumalanga Province. There appears to be no threat to any of the fruit chafer beetles of particular high conservation priority if the site is developed.

6 IMPACT ASSESSMENT AND MITIGATION MEASURES

Habitats of threatened plants are in danger most often due to urban developments such as is the case for the Gauteng Province (Pfab & Victor, 2002). Habitat conservation is the key to the conservation of invertebrates such as threatened butterflies (Deutschländer and Bredenkamp 1999; Edge 2002, 2005; Terblanche, Morgenthal & Cilliers 2003; Lubke, Hoare, Victor & Ketelaar 2003; Edge, Cilliers & Terblanche, 2008). Furthermore corridors and linkages may play a significant role in insect conservation (Pryke & Samways, 2003, Samways, 2005).

Urbanisation is a major additional influence on the loss of natural areas (Rutherford & Westfall 1994). In the Gauteng the pressure to develop areas are high since its infrastructure allows for improvement of human well-being in some way. Urban nature conservation issues in South Africa are overshadowed by the goal to improve human well-being, which focuses on aspects such as poverty, equity, redistribution of wealth and wealth creation (Cilliers, Müller & Drewes 2004). Nevertheless the conservation of habitats is the key to invertebrate conservation, especially for those red listed species that are very habitat specific. This is also true for any detailed planning of corridors and buffer zones for invertebrates. Though proper management plans for habitats are not in place, setting aside special ecosystems is in line with the recent Biodiversity Act (2004) of the Republic of South Africa.

Corridors are important to link ecosystems of high conservation priority. Such corridors or linkages are there to improve the chances of survival of otherwise isolated populations (Samways, 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways, 2005). For an African butterfly assemblage this is about 250m when the corridor is for movement as well as being a habitat source (Pryke and Samways 2003). Hill (1995) found a figure of 200m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways, 2005). Much more research remains to be done to find refined answers to the width of grassland corridors in South Africa. The width of corridors will also depend on the type of development, for instance the effects of the shade of multiple story buildings will be quite different from that of small houses.

To summarise: In practice, as far as residential developments are concerned, the key would be to prioritise and plan according to sensitive species and special ecosystems.

In the case of this study site the condition of the natural vegetation appears to be moderate to low. There appears to be no loss of any particular unique ecosystems, if the site is developed. There appears to be no loss of any particular sensitive species, if the site is developed.

The following potential impacts and mitigation measures with a view to the proposed developments apply:

6.1 Anticipated risks or impacts to the loss of habitat

The following impacts on the loss of habitat apply at the site.

Potential impacts on the available habitat will be of local extent, of permanent duration, of medium intensity and high probability. The significance of loss of habitat is expected to be moderate without mitigation and low with mitigation.

Impact summary matrix:

Phase	Significance of Impact				
	None	Low	Moderate	High	With mitigation
Operational		X			Low

Mitigation measures:

- Present exotic and invasive plant species should be eradicated at the site to be (which was) developed.

6.2 Anticipated risks or impacts to the loss of sensitive species

Sensitive species are regarded here as those listed in section 5 and constitutes the fauna and flora species that are red listed or of known particular high conservation importance. It is unlikely that the any fauna species and flora species of particular high conservation priority occur on the

site. No particular mitigation measures for sensitive species could apply since it is unlikely that any such species occur on the site.

6.3 Anticipated risks or impacts to habitat connectivity and open space

Potential impacts on connectivity will be of local extent, of permanent duration, of low intensity and low probability. The significance of the impacts on loss of connectivity is expected to be low without mitigation and low with mitigation.

Impact summary matrix: habitat connectivity

Phase	Significance of Impact				
	None	Low	Moderate	High	With mitigation
Construction		X			Low
Operational		X			Low

Mitigation measures:

- Present exotic and invasive plant species should be eradicated where appropriate.

6.4 Anticipated risks or impacts associated with construction activities

Overall construction activities associated with the development if approved will be of local extent, of medium duration, of high intensity and high probability. During the construction phase, the significance of the impacts associated with the construction phase is likely to be moderate without and low with mitigation.

Impact summary matrix:

Phase	Significance of Impact				
	None	Low	Moderate	High	With mitigation
Construction		X			Low

Mitigation measures:

- No exotic invasive plant species should be planted in the areas to be developed, if the development is approved.
- Present exotic and invasive plant species should be eradicated at the site to be developed.

7 RECOMMENDATION

- If the development is approved, exotic weeds that occur at the site should be eradicated.

8 CONCLUSION

Ecologically the site appears to range from a moderate to a degraded field condition. Combined with the low micro-habitat diversity of the site the overall diversity of indigenous plants and animals is suspected to be low. No loss of particular habitat or connectivity is foreseen if the development is approved. It is unlikely that there will be a loss of any plant species of particular high conservation priority, i.e. threatened, near threatened, declining or particularly rare species, if the site is developed. It is unlikely that there are any threatened animal species or any animal species of particular conservation importance at the site. It is therefore concluded that if the site is developed, there would be no threat to any red listed animal or plant species.

If the development is approved, opportunities to cultivate indigenous vegetation in a highly modified area (urbanisation, agriculture) present itself.

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APPENDIX 1

List of plant species recorded at the site.

Plant species are listed alphabetically under life forms that are generally recognizable.

Plant species marked with an asterisk (*) are exotic.

PLANT GROUPS AND SPECIES	COMMON NAME	PLANT FAMILY
GRASSES/ GRAMINOIDS		
<i>Cynodon dactylon</i>	Couch Grass	POACEAE Grass family
<i>Digitaria eriantha</i>	Common Finger Grass	POACEAE Grass family
<i>Eleusine coracana</i>	Goose Grass	POACEAE Grass family
<i>Eragrostis chloromelas</i>	Narrow Curly Leaf	POACEAE Grass family
<i>Eragrostis curvula</i>		POACEAE Grass family
<i>Hyparrhenia hirta</i>	Common Thatching Grass	POACEAE Grass family
<i>Melinis repens</i>	Natal Red Top	POACEAE Grass family
* <i>Paspalum dilatatum</i>	Dallis Grass	POACEAE Grass family
* <i>Pennisetum clandestinum</i>	Kikuyu	POACEAE Grass family
<i>Sporobolus africanus</i>	Ratstail Dropseed	POACEAE Grass family
HERBS, SEDGES AND GEOPHYTES		
* <i>Argemone ochroleuca</i>	White-flowered Mexican Poppy	PAPAVERACEAE
<i>Berkheya radula</i>		ASTERACEAE
* <i>Bidens bipinnata</i>	Spanish blackjack	ASTERACEAE
* <i>Bidens pilosa</i>	Common blackjack	ASTERACEAE
* <i>Chenopodium album</i>	White Goosefoot	CHENOPODIACEAE
* <i>Cirsium vulgare</i>	Scotch Thistle	ASTERACEAE
* <i>Conyza albida</i>	Tall Fleabane	ASTERACEAE
<i>Conyza podocephala</i>		ASTERACEAE
<i>Helichrysum nudifolium</i>		ASTERACEAE
<i>Helichrysum rugulosum</i>		ASTERACEAE

<i>Monopsis decipiens</i>		LOBELIACEAE
<i>Nemesia fruticans</i>	Wildeleeubekkie	SCROPHULARIACEAE
* <i>Oenothera rosea</i>	Rose Evening Primrose	ONAGRACEAE
* <i>Oenothera tetraptera</i>	White Evening Primrose	ONAGRACEAE
* <i>Plantago lanceolata</i>	Narrow-leaved plantain	PLANTAGINACEAE
* <i>Schkuhria pinnata</i>	Dwarf Marigold	ASTERACEAE
<i>Senecio inaequidens</i>	Canary Weed	ASTERACEAE
<i>Solanum panduriforme</i>	Poison Apple	SOLANACEAE
* <i>Sonchus oleraceus</i>	Sow Thistle	ASTERACEAE
* <i>Tagetes minuta</i>	Khakiweed	ASTERACEAE
* <i>Verbena aristigera</i>	Fine-leaved Verbena	VERBENACEAE
* <i>Verbena brasiliensis</i>		VERBENACEAE
SHRUBS		
<i>Gomphocarpus fruticosus</i> (= <i>Asclepias fruticosa</i>)	Milkweed	APOCYNACEAE
<i>Seriphium plumosum</i> (= <i>Stoebe vulgaris</i>)	Bankrupt Bush	ASTERACEAE
TREES		
* <i>Eucalyptus camaldulensis</i>	Red River Gum Bloekom	MYRTACEAE